# NGVs, Light Trucks, & the Mid-Term Evaluation

## Meeting with Environmental Protection Agency, 12/14/17

VNG®

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ARIEL

# VNG and Ariel – Who We Are

- VNG and Ariel are collaborating on this regulatory initiative
- Ariel is the largest manufacturer of reciprocating gas compressors in the world
- VNG builds CNG fueling for light- & medium-duty fleets at existing gasoline stations
  - High-visibility locations that are accessible, convenient, and consumer-friendly, with full service C-store retail amenities; major contrast to heavy-duty CNG private fleet depots, utility yards
  - Locations in Philadelphia, Houston, Dallas, and Milwaukee
  - Discussions with major light-duty fleet for fueling in California (operates ~4,000 NGVs in state)
- VNG has been a leading voice for light-duty NGVs, cited in original 2017-2025 rule

# Expanding Compliance Options for Light Trucks

## The Problem With Low Gasoline Prices

- As noted in TAR, market shift towards light trucks reduces aggregate emissions benefits of regulations, even if individual OEM targets adjust to compensate
- Battery cost and weight means no EV pickups for foreseeable future – the OEMs' most popular, profitable, and polluting vehicles

## NGVs Could Be The Solution – With EPA Support

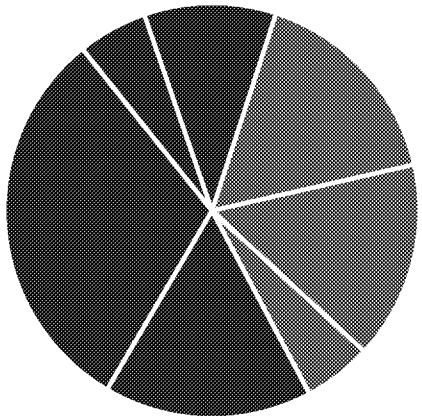
- NGVs have seen dramatic, game-changing reductions in lifecycle emissions since original rulemaking, thanks to major uptake of renewable natural gas (RNG)
- OEMs have already experimented with NGV pickups with limited production of Dodge Ram and Chevy Silverado bi-fuels, CNG-ready Ford F-150

**With revised incentives that recognize rapid growth of RNG fueling, NGVs could be a key low-emission compliance pathway for light trucks for 2025 and beyond.**

# Shift To Light Trucks Eroding Benefits of Rules

## YTD 2017 Sales

**LIGHT TRUCKS**
**63%** of YTD 2017 auto sales
+4.6% from YTD 2016



**CARS**
**42%** of YTD 2017 auto sales
**-10.3%** from YTD 2016

Source: Wall Street Journal

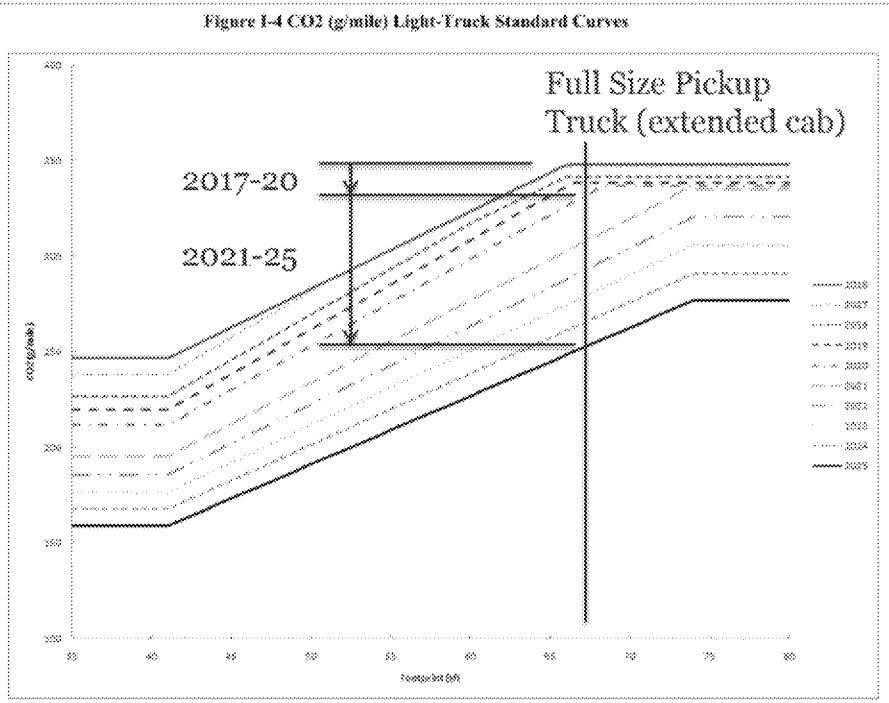
- Gasoline prices have plunged since rulemaking, shifting market to larger vehicles
- Not a current compliance problem for OEMs, since targets adjust to sales mix
- BUT shift will reduce aggregate emissions benefits of regulations
- Growing OEM concerns about limited compliance options for light trucks - and pickups especially

# Emission Solutions for Pickups Most Urgently Needed

- Pickups are the top-selling vehicles, most profitable, and most polluting
- Pickups also face the most dramatic increase in CO2 emission requirements in 2021-2025 period – biggest challenge for automakers, few tech options

- No EV alternatives for foreseeable future (2025+) due to weight and utility requirements (2016 TAR)
- Natural gas (or natural gas-ready) versions of Chevy Silverado, Dodge Ram, and Ford F-150 have already been rolled out by OEMs

**With support from EPA, NGVs could be best compliance pathway for automakers for light trucks for 2025 and beyond.**




Source: Westport

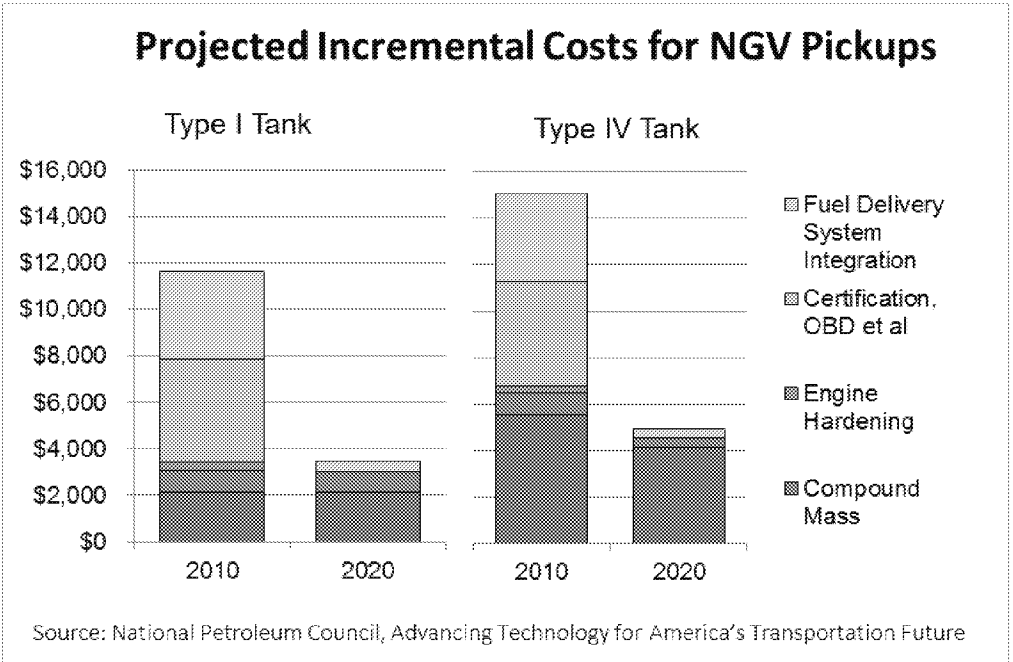
# RNG: From 0% to 35% of NGV Fueling Since 2012

- **Original rulemaking:** *"Biomethane will remain a small part of the overall natural gas market for the foreseeable future"…*
- **Today:** Biomethane/RNG accounts for about 35% of national NGV fueling, 60% in California (Fleets & Fuels) – and growing as fast as RNG projects can come online
- **Why?** Regulations - and economics. RNG reclassified as cellulosic biofuel in 2014, RIN revenues of ~$23/MMBTU (UC Davis) make it more profitable than fossil.
  - —3x revenues from transportation vs electricity sales (CARB)
  - —California adds another $11+/MMBTU for LCFS sales (UC Davis)
- **Game-Changing Emissions:** Lowest carbon intensity of any fuel measured under California's Low Carbon Fuel Standard – **pathways up to -304 gCO2e/MJ** (CARB)

**Economics of RFS and LCFS will ensure continued growth in RNG use for NGVs, and growth in NGV market will be primary driver of new RNG capture projects.**

# Major NGV Cost Reductions With Scale

- NGVs have far greater potential for rapid incremental cost reductions than EVs, as costs come from design/regulatory – not components (i.e. batteries)
- Fuel system integration + certification are >50% of NGV incremental costs (NPC)
- Fixed costs virtually eliminated overnight if spread over large number of vehicles
- Precedent in Europe (e.g. Italy), where OEM-produced NGVs retail for <$3,000 more than gasoline model (BCG)
- $3,000 is projected cost to lightweight pickup truck for 10% emissions improvement (TAR)
- NGVs offer comparable cost with much greater emission reduction



# Advanced Tech for Ultra-Low NGV Pickup Emissions

- NGVs already commercial tech – but can be pushed much farther by taking advantage of high octane, clean-burning properties of gas
- Westport (Cummins JV partner) has proposed "Super Pickup Truck" NGV concept with >30% greater fuel economy, ultra-low NOx
- Advanced tank technologies (e.g. adsorption) another avenue of improvement
- Hybrid/Plug-In Hybrid pathway offers further potential emission reductions

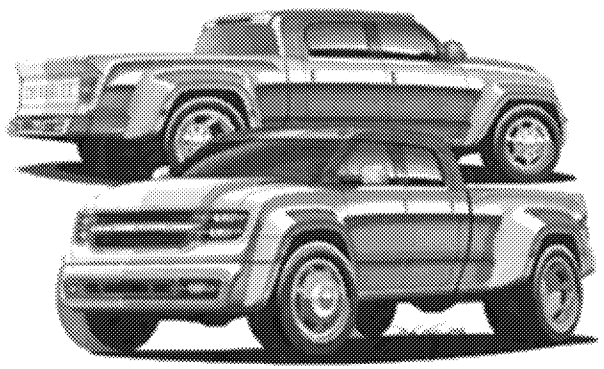
***Advanced powertrains that fully exploit ultra high-octane low-carbon fuel properties of methane***

*a. Not been done to-date – missed opportunity*

*b. High efficiency and high performance at the same time, outperform gasoline and diesel*

*c. >30% CO2 reduction TTW*

**- Westport, "Methane: The Performance Fuel"**

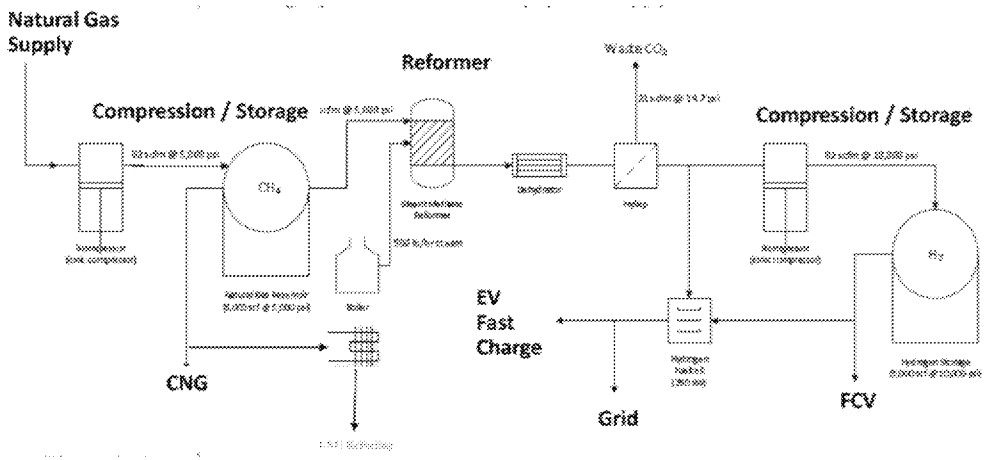


# NGV Synergies With Hydrogen

- Vehicle synergy via gaseous fuel storage tech (e.g. adsorption tanks)
- CNG/H2 fueling can be combined, or else CNG stations can be transitioned to H2 at a later date due to shared components
- RNG is also fuel for ultra-low GHG H2 production – NGVs develop market for production infrastructure today for H2 fueling tomorrow

*"Planning for the addition of H2 infrastructure at CNG fueling locations can facilitate the adoption of hydrogen at a later date and smooth the transition to near zero carbon technologies."*

**- UC Davis STEPS Program**



# Proposed Reforms to GHG Rules – 0.15 Divisor

**Return to "0.15 divisor":** Calculate CNG emissions as 0.15x gasoline emissions, as in the pre-MY 2016 GHG regulations

- Equivalent to 85% reduction, reflects game-changing lifecycle RNG emissions (some pathways achieve 100% or more)
- Analogous to EV 0 g/mi incentive that assumes 100% renewable electricity; instead, assumes 100% RNG use
  - *RNG use of 35% nationally and growing is equal to % of zero-carbon electricity (renewables + nuclear) in national mix*
- Like EV incentive, can be transitioned to real-world lifecycle emissions based on national RNG use (can use RFS data)
- Harmonizes with CAFE Petroleum Equivalency Factor (PEF)

**A return to the 0.15 divisor could enable OEMs to achieve existing 2025 targets and establish NGVs as long-term compliance pathway for light trucks.**

# Proposed Reforms to GHG Rules – Dual-Fuel Design

**Remove utility factor design requirements for dual-fuel NGVs:** Eliminate need for 2:1 CNG-to-gasoline range ratio, use of gasoline only when CNG tank is empty

- Dual-fuel vehicles critical to building NGV market as fueling develops, like PHEVs
- Fastest, lowest-cost pathway is adding CNG tank to existing gasoline vehicle
- However dual-fuel NGVs face unique design requirements to receive utility factor, despite having much greater CNG range vs PHEV electric-only range
- Forces automakers to add cost (from shrinking and redesigning gasoline tank) and decrease total range and utility (from increased size of CNG tanks) if they want to receive full utility factor incentives
  - **Example:** FCA chose design simplicity over incentives with Dodge Ram dual-fuel, with 255 miles of CNG range and nearly 400 miles of gasoline range

**These design requirements are as unnecessary for dual-fuel NGVs as for PHEVs, and will force OEMs to either limit consumer appeal or lose incentives.**

# Proposed Reforms to GHG Rules – Pickup Incentive

**NGV Pickup Incentive:** Create full-size pickup incentive equivalent to hybrid incentives for both dedicated and dual-fuel NGVs with **no** minimum penetration

- Cleaner technologies for pickups badly needed, but currently no projected use of existing full-size pickup advanced technology incentives (2016 TAR)
- NGVs are ideal next-gen pickup platform and could qualify for performance-based incentive (<15% emission reduction)…
- But 10% minimum penetration threshold too high for alternative fuel vehicles; too risky for OEMs to make big, immediate move in critical profit segment
- Removing threshold and awarding incentives for every NGV pickup would encourage OEMs to experiment, invest in new technology

**NGV-specific incentive would surpass original goals of full-size pickup incentives by providing new platform for continuous, long-term efficiency improvements**

# Proposed Reforms to GHG Rules – Retrofits

**Retrofit Credits:** Create credits based on remaining useful life of converted vehicle: for instance, conversion of 5 year-old pickup would get credit for 50% emission reductions as a new vehicle; credits awarded to converter, can be sold to OEMs

- Vehicle life steadily increasing beyond 10 years, likely to continue growing as vehicle prices increase – how to avoid erosion of program benefits?
- NGV retrofits offer pathway to reduce emissions from vehicles significantly during their useful life – very successful in Utah, Oklahoma
- These emission benefits not currently captured in (or incentivized by) rules
- Synergies with EPA reforms to certification rules in 2011
- Could also add off-cycle credits for CNG-ready "prep packages" (e.g. Ford F-150)

**Incorporating retrofits is an "outside the box" solution that would accelerate progress and honor EPA mandate to regulate emissions throughout useful life**

# Action On NGV Light Trucks is Major Opportunity

**Incentivizing NGVs as part of GHG rules ensures continued progress on not only emission reductions but on vehicle and fuel technologies:**

- Introduces low-emission options for pickups a decade or more in advance of EV technologies in this segment
- Shifts trajectory of potential emissions improvements for light truck segment, allowing more ambitious post-2025 targets
- Pathway to near-zero emissions and beyond with advanced ICE engines, RNG, and hydrogen synergies
- Drives market for RNG capture, realizing massive lifecycle emission reductions and cost-effective waste recovery that compliments broader EPA agenda

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